

Predictors of Success and Major Complications for Primary Percutaneous Transluminal Coronary Angioplasty in Acute Myocardial Infarction

An Analysis of the 1990 to 1994 Society for Cardiac Angiography and Interventions Registries

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Objectives. The purpose of this study was to determine predictors of successful coronary angioplasty for acute myocardial infarction (MI) and associated predictors of the major complications of in-hospital mortality and emergency coronary artery bypass graft surgery.

Background. Primary angioplasty is being increasingly used to treat acute MI, but factors affecting the success and major complications have not been well studied. Forty laboratories have been contributing clinical and procedural data to the Society of Cardiac Angiography and Interventions (SCA&I) on primary angioplasty for acute MI.

Methods. Univariable and stepwise multivariable logistic regression analysis of clinical and procedural variables was used to calculate predictors of success and major complications.

Results. There were 4,366 primary angioplasty procedures reported from 1990 through 1994, with an overall success rate of

91.5%, an in-hospital mortality rate of 2.5% and a rate of emergency surgery of 4.3%. Higher laboratory primary angioplasty volume and lower age were predictive of success. An intraaortic balloon pump in place, cardiogenic shock and a moribund condition had negative predictive effects. Unsuccessful angioplasty, cardiogenic shock or a moribund state were predictive of in-hospital death. Unsuccessful angioplasty, the absence of a history of hypertension and the absence of congestive heart failure were predictive of emergency surgery.

Conclusions. The rates of success and major complications in the SCA&I Registry are similar to other series. Predictors of success and major complications can be assessed and may be useful for risk stratifying candidates for primary angioplasty in acute MI.

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Over the past decade, several large trials of thrombolytic therapy for acute myocardial infarction (MI) have been completed (1-7). On the basis of these trials, thrombolytic therapy has become the standard of care for acute MI. Some of the disadvantages of this therapy include recurrent ischemia, failure to achieve arterial patency in ~20% of cases and serious hemorrhagic complications. Because of these limitations, there has been increasing interest in the use of primary percutaneous transluminal coronary angioplasty (PTCA) as an alternative to thrombolytic therapy. A number of small trials have shown less recurrent ischemia, early patency rates >90% and low rates of serious hemorrhage with primary angioplasty (8-10). A recent

larger multicenter study involving 12 institutions, the Primary Angioplasty in Myocardial Infarction trial (PAMI), showed that primary angioplasty, compared with tissue-type plasminogen activator therapy, reduced the combined occurrence of nonfatal reinfarction or death, was associated with a lower rate of intracranial hemorrhage and resulted in similar left ventricular systolic function (11).

In the PAMI series, the overall success rate for PTCA was 97.1%. No patient required emergency coronary artery bypass graft surgery (CABG) because of the failure of PTCA. Although the PAMI study indicated a high rate of success, it did not examine some of the reasons for success or failure of PTCA. The Society for Cardiac Angiography and Interventions (SCA&I) maintains an extensive data base of cardiac catheterization and coronary intervention procedures. One hundred ten cardiac catheterization laboratories contribute to the Society's Registry. Of these, 40 have contributed coronary intervention procedure results to the PTCA Registry during the period 1990-1994. The purpose of this study was to calculate predictors of successful PTCA, in-

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Abbreviations and Acronyms

CABG	= coronary artery bypass graft surgery
CHF	= congestive heart failure
CI	= confidence interval
IABP	= intraaortic balloon pump
MI	= myocardial infarction
OR	= odds ratio
PAMI	= Primary Angioplasty in Myocardial Infarction trial
PTCA	= percutaneous transluminal coronary angioplasty
SCA&I	= Society of Cardiac Angiography and Interventions
TIMI	= Thrombolysis in Myocardial Infarction

hospital mortality and emergency CABG for PTCA performed as primary therapy for acute MI from the SCA&I 1990 to 1994 Registry data.

Methods

Patient selection. From January 1, 1990 to December 31, 1994, 78,199 coronary intervention procedures were reported in the SCA&I Registry. Of these, 4,366 were performed within 24 h of the onset of an acute MI without the administration of thrombolytic therapy, and form the basis for this analysis. Demographic and clinical variables were used and compared with the end points of successful PTCA, emergency CABG or in-hospital mortality. The PTCA Registry has been described in detail in a previous publication (12). The PTCA Registry variables include the procedures performed; the occurrence of previous PTCA, previous CABG and acute and previous MI; the presence of diabetes, hypertension, impaired renal function, dialysis, cardiogenic shock, moribund status, unstable angina, congestive heart failure (CHF) and previous dye allergy; contrast medium; procedure details; vessel treated; and indication of success and complications.

Variable definitions. Acute MI is defined as a Q wave or non-Q wave MI as manifested by electrocardiographic changes or an increase in cardiac enzymes, or both, within the past 24 h. Diabetes is defined for patients receiving oral hypoglycemic agents or insulin. Hypertension is defined as diastolic pressure ≥ 100 mm Hg, or if patients are receiving antihypertensive medications. Impaired renal function refers to a creatinine level >2 mg/dl. Unstable angina is defined as crescendo angina despite good medical therapy with or without rest ischemic changes. Congestive heart failure includes but is not limited to pulmonary edema, jugular venous distention, hepatomegaly, gallop rhythm or peripheral edema. Cardiogenic shock is defined as unsupported systolic pressure <80 mm Hg with a heart rate >95 beats/min, peripheral signs of vascular collapse such as cool, moist skin and a rapid thready pulse, decreased urinary output and rapid, shallow breathing. Moribund status includes patients entering the laboratory in cardiogenic shock, on a ventilator or intraaortic balloon pump (IABP), on high doses of vasopressors or receiving cardiopulmonary resuscitation. Several variables from the data base

were selected for analysis. These were laboratory volume of PTCA for acute MI, age, gender, intracoronary thrombolysis, use of the IABP, previous MI, previous CABG, diabetes, hypertension, shock, moribund state, CHF and previous PTCA at the same site. In addition, the occurrence of emergency CABG and hospital mortality were examined and compared with other series.

Statistics. We used univariable analysis, followed by multivariable logistic regression analysis (13), to identify independent predictive variables from the categorical and continuous variables. Forward and backward stepwise regression was performed. Odds ratios (ORs) were provided to estimate the probability of patients with a given variable having an increased likelihood of successful angioplasty outcome, having in-hospital death or having emergency CABG, as compared with all other patients without the variable. Stepwise multivariable logistic regression analysis was used to identify predictors of success and the aforementioned complications. The 95% confidence interval (CI) of the OR was computed, and if the 95% CI did not contain the value 1, the association between the predictor and successful outcome was statistically significant at the 0.05 level. All analyses were performed using standard statistical software (SYSTAT 5.1, LOGIT 2.0, PRIMER). Categorical data are presented as numbers and percentages, and continuous variables are presented as mean value \pm SD.

The effect of operator volume on successful PTCA was studied by calculating the correlation coefficient between operator volume and the percentage of that operator's successful cases in primary PTCA for acute MI.

Results

Patients. The clinical and angiographic characteristics of the patients are shown in Tables 1 and 2. The average number of angioplasty procedures for acute MI per laboratory in the 1990-1994 Registries was 23, with a minimum of one procedure and a maximum of 145 procedures (median 16). In patients with no previous CABG, the coding system did not identify the infarct-related vessel. The success rate for PTCA was 91.5%. There were 116 in-hospital deaths, for a mortality rate of 2.6%. Emergency CABG was performed 150 times, for a rate of 3.4%.

Successful PTCA. Univariable analysis of successful PTCA is shown in Table 3. Successful PTCA occurred more frequently in high volume laboratories, with younger patients, when no IABP was in place, when the patient was not in cardiogenic shock or moribund and when the patient had no previous CABG. The variable that achieved statistical significance on multivariable logistic regression analysis as a predictor of success was laboratory primary PTCA volume (OR 1.002, 95% CI 1.000 to 1.005, $p = 0.04$, for each additional primary PTCA). Predictors of an unsuccessful procedure were age (OR 0.99, 95% CI 0.99 to 0.98, $p = 0.004$, for each additional year of age), an IABP in place (OR 0.48; CI 0.62 to 0.37, $p < 0.001$), cardiogenic shock (OR 0.64, 95% CI 0.89 to

Table 1. Clinical Characteristics of 4,366 Patients

Age (yr)	61 ± 12.0
Gender	
Female	29.9%
Male	70.1%
Intracoronary thrombolysis	
No	88.3%
Yes	11.7%
IABP	
No	87.2%
Yes	12.8%
Prior CABG	
No	94.5%
Yes	5.5%
Diabetes	
No	87.3%
Yes	12.7%
Hypertension	
No	71.2%
Yes	28.8%
Cardiogenic shock	
No	92.8%
Yes	7.2%
Moribund	
No	96.5%
Yes	3.5%
Unstable angina	
No	62.0%
Yes	38.0%
CHF	
No	94.8%
Yes	5.2%

Data presented are mean ± SD or percent of patients. CABG = coronary artery bypass graft surgery; CHF = congestive heart failure; IABP = intraaortic balloon pump.

0.45, $p = 0.009$) and moribund status (OR 0.48, 95% CI 0.74 to 0.32, $p = 0.001$). The ORs are shown graphically in Figure 1. As one can see, higher laboratory volume was slightly predictive of success, and older age was more likely to predict an unsuccessful result. An IABP in place, cardiogenic shock and a moribund status were predictive of an unsuccessful result.

Hospital death. Univariable analysis of hospital death is shown in Table 4. Hospital survivors were younger and treated in high volume laboratories. Variables occurring more frequently for hospital deaths were female gender, an IABP in place, a history of hypertension, cardiogenic shock, moribund status, and CHF. Interestingly, hospital survivors more frequently had a previous MI. Variables predictive of in-hospital death (Fig. 2) with multivariable analysis were unsuccessful PTCA (OR 0.14, 95% CI 0.23 to 0.09, $p < 0.0001$), cardiogenic shock (OR 8.52, 95% CI 13.85 to 5.24, $p < 0.0001$) and moribund status (OR 2.94, 95% CI 5.35 to 1.61, $p < 0.0001$).

Emergency CABG. Univariable analysis of the need for emergency CABG is shown in Table 5. Variables occurring more frequently for patients needing emergency CABG were IABP, cardiogenic shock, moribund status and previous successful PTCA performed at a different site. Patients not

Table 2. Vessel Characteristics

	% of Vessels
Prior successful PTCA (n = 606)	
Same site	75.2
Different site	24.8
Vessel treated	
Prior CABG (n = 305)	
Coronary artery	50.8
SVG	49.2
No prior CABG (n = 5,177)	
LAD	41.6
LCx	17.8
RCA	40.6

CABG = coronary artery bypass graft surgery; LAD = left anterior descending coronary artery; LCx = left circumflex coronary artery; PTCA = percutaneous transluminal coronary angioplasty; RCA = right coronary artery; SVG = saphenous vein graft.

requiring emergency CABG more frequently had a history of hypertension or had CHF. Variables predictive of emergency CABG from multivariable analysis (Fig. 3) were the absence of hypertension (OR 0.55, 95% CI 0.87 to 0.34, $p = 0.012$), the absence of CHF (OR 0.10, 95% CI 0.75 to 0.01, $p = 0.025$) and unsuccessful PTCA (OR 0.02, 95% CI 0.03 to 0.01, $p < 0.0001$).

The correlation between operator volume in performing primary PTCA and the percentage of successful cases was low ($r = 0.46$).

Discussion

Success. The success rate of angioplasty in MI has been reported as 85% to 97% (11,14–19). The overall success rate in the 5 years of the Registry was 91.5%. This is somewhat less than the success rates in these other series. In the Society's registries, however, the success rates progressively increased over the 5-year period 1990–1994, from 86.7%, 87.4%, 90.6%, 91.3% to 92.4%, respectively. Many of the previously cited references with higher success rates were reported in 1993 and 1994. It appears then that the success rates are comparable to those reported in other series. The low correlation between operator PTCA volume and percentage of successful PTCA reported should be taken with a note of caution. For example, the overall number of procedures (including those for acute MI) done by individual operators in 1990 varied from 1 to 232.

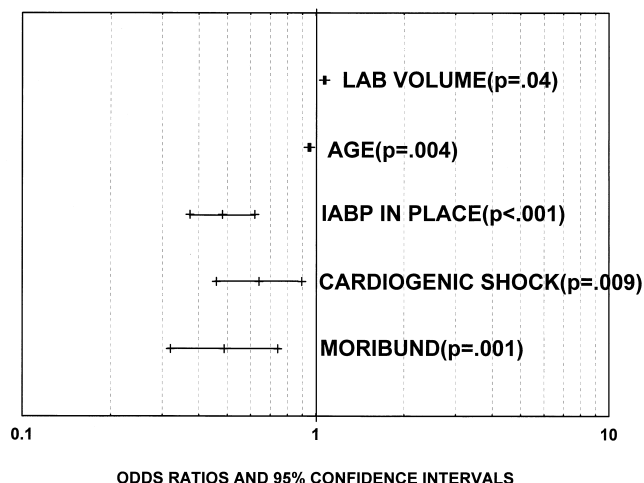
In our series the variables that were predictive of unsuccessful angioplasty were older age, lower laboratory PTCA volume, the presence of an IABP, moribund status and cardiogenic shock. An IABP is an obvious predictor because it is usually associated with sicker patients. Intuitively, one would expect that higher volume institutions would tend to have more successful results than those institutions with a lower volume. In contrast, one can argue that most laboratories should tend to have similar success rates because of selection bias. High

Table 3. Patient Variables for Successful Versus Unsuccessful Results

Variable	No. of Pts	Successful PTCA	Unsuccessful PTCA	p Value
Lab vol		71.7 ± 57.0	64.7 ± 51.0	0.012
Age (yr)		60.3 ± 12.1	62.4 ± 11.4	< 0.0001
Gender				0.085
Female	1,305	88.5%	11.5%	
Male	3,061	89.9%	10.1%	
Intracoronary thrombolysis				0.394
No	3,853	89.6%	10.4%	
Yes	513	88.3%	11.7%	
IABP				< 0.0001
No	3,806	90.9%	9.1%	
Yes	560	79.6%	20.4%	
Prior CABG				0.042
No	4,127	89.7%	10.3%	
Yes	239	85.4%	14.6%	
Diabetes				0.097
No	3,812	89.5%	10.5%	
Yes	554	89.5%	10.5%	
Hypertension				0.476
No	3,110	89.3%	10.7%	
Yes	1,256	90.0%	10.0%	
Cardiogenic shock				< 0.0001
No	4,053	90.4%	9.6%	
Yes	313	77.6%	22.4%	
Moribund				< 0.0001
No	4,214	90.0%	10.0%	
Yes	152	74.3%	25.7%	
CHF				0.752
No	4,137	89.5%	10.5%	
Yes	229	88.6%	11.4%	
Prior successful PTCA				0.397
Same site	449	85.7%	14.3%	
Different site	153	88.9%	11.1%	

Data presented are mean value ± SD or number or percent of patients (Pts). Lab vol = laboratory volume; other abbreviations as in Tables 1 and 2.

volume laboratories may choose more difficult cases and low volume sites less difficult cases, resulting in similar success rates. The OR for success as a function of laboratory volume

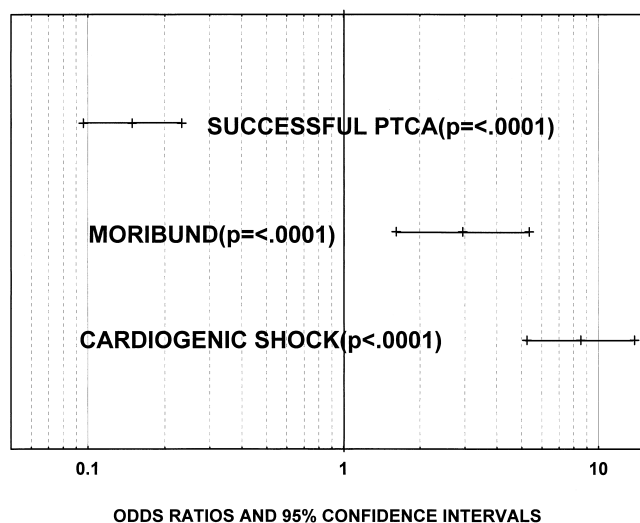
Figure 1. Predictors of successful PTCA for acute MI. LAB = laboratory.

(Fig. 1) was barely greater than zero, supporting the latter argument. In PAMI II it was found that successful PTCA was independent of operator or institutional volume (20). This may in part reflect the experience gained in the first PAMI trial and the fact that the participating institutions may have been highly selected. The presence of an IABP, cardiogenic shock and moribund status are somewhat similar variables, and it is not surprising that they were all predictive of an unsuccessful result. Hibbard et al. (21) reported on 45 patients in cardiogenic shock with acute MI for which emergency PTCA was performed. Only 62% of these patients had successful dilation of the infarct-related artery. The higher success rate for our Registry patients cannot be explained. The definition of cardiogenic shock for the Registry is unsupported systolic blood pressure <80 mm Hg with a heart rate >95 beats/min, peripheral signs of vascular collapse, decreased urinary output and rapid, shallow breathing. This definition is similar to that of other registries, but an audit of compliance with the definition was not done. Bedotto et al. (19) reported on 750 patients who had direct angioplasty for acute MI. Patients in the failure group were more likely to be in cardiogenic shock, to have had a previous MI and to have three-vessel coronary

Table 4. Patient Variables in Hospital Survivors Versus Hospital Deaths

Variable	No. of Pts	Hospital Survivor	Hospital Death	p Value
Lab vol		60.19 ± 46.1	50.25 ± 44.1	0.037
Age (yr)		60.4 ± 12.0	64.93 ± 11.2	< 0.0001
Gender				0.006
Female	1,305	96.9%	3.1%	
Male	3,061	98.2%	1.8%	
Intracoronary thrombolysis				0.592
No	3,853	97.8%	2.2%	
Yes	513	98.2%	1.8%	
IABP				< 0.0001
No	3,806	98.5%	1.5%	
Yes	560	93.2%	6.8%	
Prior MI				0.008
No	3,690	97.6%	2.4%	
Yes	676	99.3%	0.7%	
Prior CABG				0.891
No	4,127	97.8%	2.2%	
Yes	239	97.9%	2.1%	
Diabetes				0.084
No	477	84.1%	15.9%	
Yes	77	75.3%	24.7%	
Hypertension				< 0.0001
No	3,805	98.2%	1.8%	
Yes	561	95.4%	4.6%	
Cardiogenic shock				< 0.0001
No	4,053	98.8%	1.2%	
Yes	313	85.0%	15.0%	
Moribund				< 0.0001
No	4,214	98.3%	1.7%	
Yes	152	83.6%	16.4%	
CHF				< 0.0001
No	4,137	98.1%	1.9%	
Yes	229	93.4%	6.6%	
Prior successful PTCA				0.397
Same site	449	97.8%	2.2%	
Different site	153	98.7%	1.3%	

Data presented are mean value ± SD or number or percent of patients. MI = myocardial infarction; other abbreviations as in Tables 1 to 3.

Figure 2. Predictors of emergency CABG during PTCA for acute MI.

artery disease. Independent predictors of failed angioplasty were cardiogenic shock and the presence of multivessel coronary artery disease. In their series (19), age did not seem to play a role in the accomplishment of successful angioplasty. The extent of coronary artery disease (one-, two- or three-vessel disease) in the Society's PTCA Registry was not available for comparison with this study.

Emergency CABG. In the 5 years of the Registry, emergency CABG was performed 150 times, for a rate of 3.43%. Other series have reported emergency CABG rates ranging from 0% to 7.9% (11,14). In PAMI no patient required emergency CABG. As noted before, however, many of the centers participating in that trial had a high volume of procedures and had extensive experience. Predictors of emergency CABG were unsuccessful PTCA (as one would expect) and the absence of CHF and hypertension. Congestive heart failure may not be protective but may reflect a reluctance to perform

the operation in that clinical situation. The negative power of hypertension in predicting CABG is interesting but cannot be explained with the existing data.

In-hospital mortality. The in-hospital mortality rate in the 5 years of the Society's Registry was 2.66%. This compares with mortality rates ranging from 2% to 10%, with the majority being in the range of 2% to 4% (19,21-25). Thus, the mortality rate for direct angioplasty in the Society's series seems to be comparable to that reported by other institutions. In the National Registry of Myocardial Infarction Primary PTCA report of March 28, 1996, the mortality rate was 7.9% for nontransfer-in patients. In this series the infarct was antero-septal in 37% of the patients, whereas in the SCA&I Registry this percentage was 25%. In addition, the average ejection fraction of our patients was 46%. Thus, our lower mortality may reflect a lower risk group of patients. The lower mortality rates may also be due to variations in reporting methods among hospitals. Some hospitals follow patients throughout their hospital period, by their catheterization laboratory staff or their quality assurance departments, or both. The variation of this follow-up from hospital to hospital is unknown.

It is known that Thrombolysis in Myocardial Infarction (TIMI) flow rates correlate with success and survival. Unfortunately, rates after angioplasty are not a part of the SCA&I data base. We were able to assess one specific institution's TIMI flow rates for 1993 and 1994. A TIMI flow grade of 3 was achieved in 84.2% of the cases. Although 11% of our patients received intracoronary thrombolytic therapy, which is higher than the 5% in the PAMI series, this higher percentage probably reflects thrombolysis being more commonly done in the early 1990s throughout the country. Bailout stents were very infrequently used because of their unavailability to most of the participating laboratories.

Miller et al. (14) analyzed 117 patients who had undergone primary angioplasty for acute MI in a single institution. Variables that were analyzed were age, gender, previous MI, the presence of cardiogenic shock, the specific infarct-related vessel, stenosis severity (subtotal or total) and the occurrence of successful PTCA. They found that older age, the presence of cardiogenic shock and unsuccessful angioplasty were more frequently seen in the patients with in-hospital deaths. Table 4 shows our univariable analysis from the 1990-1994 Registries.

Table 5. Patient Variables: No Emergency Versus Emergency Coronary Artery Bypass Graft Surgery

Variable	No. of Pts	No CABG	CABG	p Value
Lab vol		60.1 ± 46.0	57.5 ± 46.4	0.512
Age (yr)		60.5 ± 12.1	60.9 ± 10.1	0.7
Gender				0.351
Female	1,305	96.4%	3.6%	
Male	3,061	97.0%	3.0%	
Intracoronary thrombolysis				0.964
No	3,853	96.8%	3.2%	
Yes	513	96.7%	3.3%	
IABP				< 0.0001
No	3,806	97.2%	2.8%	
Yes	560	94.1%	5.9%	
Prior MI				0.231
No	3,690	96.7%	3.3%	
Yes	676	97.6%	2.4%	
Prior CABG				0.239
No	4,127	96.7%	3.3%	
Yes	239	98.3%	1.7%	
Diabetes				0.58
No	525	76.4%	23.6%	
Yes	73	79.5%	20.5%	
Hypertension				0.01
No	3,110	96.4%	3.6%	
Yes	1,256	97.9%	2.1%	
Cardiogenic shock				< 0.0001
No	4,122	97.2%	2.8%	
Yes	288	92.4%	7.6%	
Moribund				< 0.0001
No	4,205	97.2%	2.8%	
Yes	152	91.4%	8.6%	
CHF				< 0.025
No	4,137	96.7%	3.3%	
Yes	229	99.6%	0.4%	
Prior successful PTCA				< 0.0001
Same site	449	92.0%	8.0%	
Different site	189	80.4%	19.6%	

Data presented are mean value ± SD or percent of patients. Abbreviations as in Tables 1 to 4.

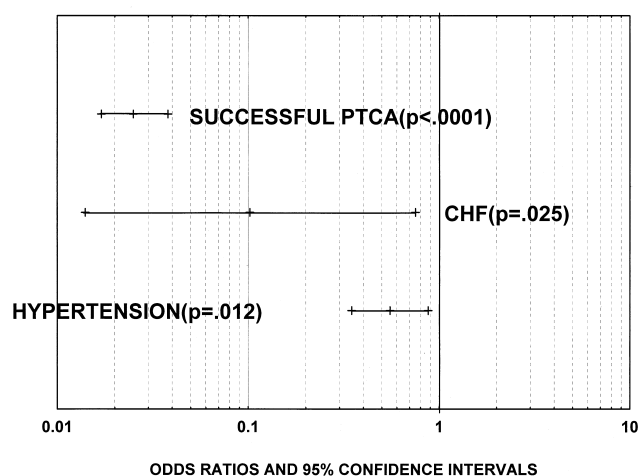


Figure 3. Predictors of death during PTCA for acute MI.

In our series, younger patients from higher volume laboratories; male patients; those not in cardiogenic shock or requiring an IABP; those with no previous MI; those without hypertension, cardiogenic shock, moribund status or CHF; and those having successful angioplasty more frequently survived during their hospital stay. Thus, our findings are similar to these investigators for this univariable analysis. For multivariable analysis, however (Fig. 2), age and gender were not independent predictors of in-hospital death.

O'Keefe et al. (15) analyzed several variables as predictors of in-hospital mortality during primary angioplasty for acute MI. These variables included the presence of cardiogenic shock, age ≥ 70 years, the occurrence of failed angioplasty and previous CABG. O'Keefe et al. found that cardiogenic shock, age ≥ 70 years and failed angioplasty were predictors of in-hospital death. Kimmel et al. (26) analyzed all of the 1992 PTCA data (not just that of primary PTCA for acute MI) of the SCA&I for predictors of major complications (emergency CABG, MI or death). Predictors of major complications were multivessel disease, unstable angina, recent MI, a type C lesion or left main coronary angioplasty, shock, age, geographic region and absence of previous CABG. The fact that we found only three predictors of death is probably due to our narrower patient group and narrower end point of only deaths. In another Registry study, Kimmel et al. (27) analyzed the relation between coronary angioplasty procedure volume and major complications. Using multivariable analysis they found a statistically significant decrease in major complications (death, MI, emergent CABG) when laboratories performing more than 400 procedures/year are compared with those performing fewer than 200/year. The relation did not exist for our analysis of predictors of death or emergency CABG, but it did appear for successful PTCA outcome. Again, the reason for the difference may be in their larger combined end point (death, MI or emergency CABG).

The value of the data in this study may be in "risk stratifying" primary PTCA and outcomes and expectations. Certainly, if there is a "score card," the expectations of success should be weighted by the results of studies like these. It is

important that the lower success rate and higher mortality of these patients (referring to moribund, cardiogenic shock, very elderly) be considered when evaluating the quality of a laboratory, because if it is not, this may have a very chilling effect on the willingness of laboratories to accept these high risk patients.

Some of the limitations of this study include the fact that the data are from a registry where the data entry is not monitored or proctored, and there is no core laboratory evaluating the angiograms. Some in-hospital deaths may go undetected if there is no follow-up after the patient leaves the laboratory. In contrast, because all the laboratories use the data for quality control, there is an effort to code the data accurately. Another limitation is that there is the potential for selection bias—that is, perhaps only patients who would appear to be lower risk, with a higher probability of success, were treated with primary angioplasty. In a review of diagnostic catheterizations done at the participating institutions, 7,423 patients labeled as having an acute MI underwent angiography within 24 h of admission. The 4,366 patients who had primary PTCA thus represent 58.4% of the group. So it appears that the majority of the patients thought to be eligible for PTCA underwent the procedure.

The SCA&I receives coronary angioplasty data from a variety of different institutions. These probably represent a fairly general reflection of types of institutions across the United States, ranging from small community hospitals to large academic institutions. The rates of emergency CABG and in-hospital mortality appear to be comparable to those reported by other institutions. Higher volume centers seem to have higher success rates in direct angioplasty. Older patients are less likely to have a successful result, but this may be a reflection of other unknown factors. Cardiogenic shock in other series and in ours is more likely to predict an unsuccessful result. Variables predictive of in-hospital death were unsuccessful PTCA, cardiogenic shock or moribund status. Variables predictive of emergency CABG were unsuccessful PTCA and the absence of hypertension and CHF.

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